Perfecting Squares

Reporting Category Number and Number Sense
Topic Investigating positive exponents and perfect squares

Materials

- Perfecting Squares Grids (attached)
- Perfecting Squares Grids Key (attached)
- Perfect Squares Chart (attached)
- Multiplication Table (attached)
- Markers, crayons, or colored pencils in at least nine different colors

Vocabulary

powers, exponents, base, exponential form (6.5)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Distribute copies of the Perfecting Squares Grids handout and markers, crayons, or colored pencils in different colors so that each students has nine different colors. For each grid on the handout, have students shade the boxes along the diagonal from bottom left to top right, using a different color for each grid. Have them also write down their observations about each grid (e.g., number of blocks along the diagonal, numbers of blocks on the vertical and horizontal, total number of blocks, way to calculate the total number of blocks).
2. Question students about their observations. They should notice that each grid forms a square. Ask why they are classified as squares. (Width and length are the same.) Also, they should notice that whatever number of blocks are along the diagonal corresponds with the number of blocks in the vertical rows and in the horizontal rows.
3. Distribute the multiplication charts, and display a large version of the chart. Ask students how each of the grids can be modeled on the multiplication chart. Ask whether they can use the multiplication chart to depict other "square relationships" that are not on the grids. Explain that each square was derived from multiplying a number by itself, producing a "perfect square."
4. At this point, have students incorporate their notes by explaining/reviewing how to rewrite $9 \cdot 9$, written "9 x 9" in previous grades, in condensed form as 9^2. Have them complete their notes by naming *x* as the base and *n* as the exponent (which is exponential form). Tell them how to read it. ("nine squared" or "nine to the second power")
5. Distribute copies of the Perfect Squares Chart, and have students complete it.
6. Conclude the lesson by asking students to describe the connection between perfect squares and the area model.

Assessment

- **Questions**
  - How can the area model be used to relate perfect squares to multiplication?

Extensions and Connections (for all students)

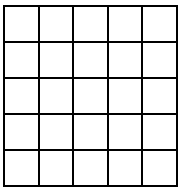
- Provide other numerical examples of positive exponents with powers greater than 2.
- Assist students in recognizing how the exponent is related to powers of ten.

Strategies for Differentiation

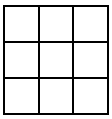
- Some students may need to use the multiplication chart throughout the lesson to complete the perfecting squares grids.
- Some students may need to number the blocks to see a connection between the grid and the multiplication chart.

Perfecting Squares Grids

Name _____ **Date** _____



Observations



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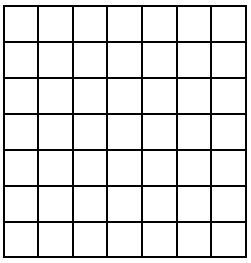
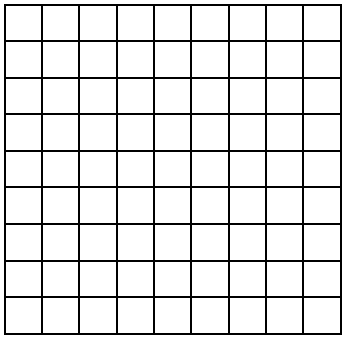


Observations



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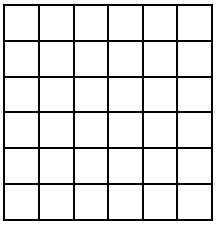

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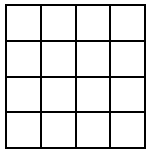

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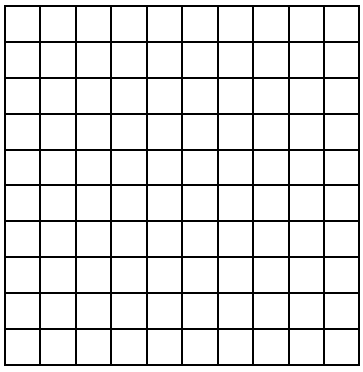

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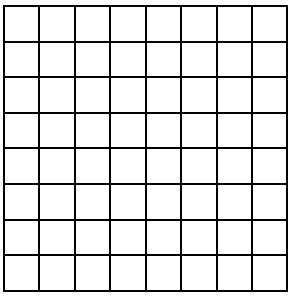
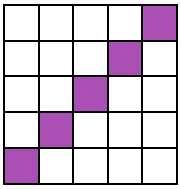


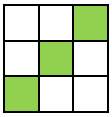
Observations

Perfecting Squares Grids Key



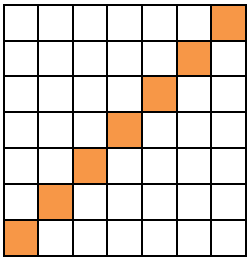
Observations

Number of blocks along the diagonal is 5.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 25, which is also the product of the length and width.



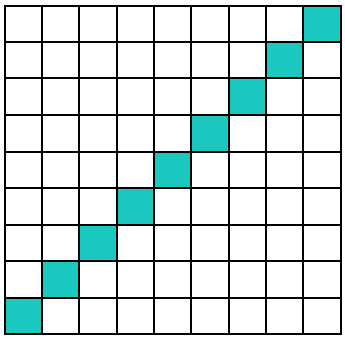
Observations

Number of blocks along the diagonal is 3.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 9, which is also the product of the length and width.



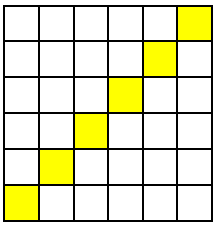
Observations

Number of blocks along the diagonal is 7.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 49, which is also the product of the length and width.



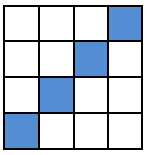
Observations

Number of blocks along the diagonal is 9.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 81, which is also the product of the length and width.



Observations

Number of blocks along the diagonal is 6.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 36, which is also the product of the length and width.

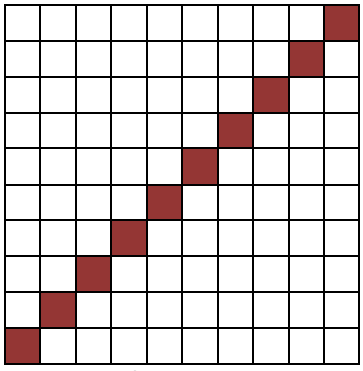


Observations

Number of blocks along the diagonal is 4.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 16, which is also the product of the length and width.

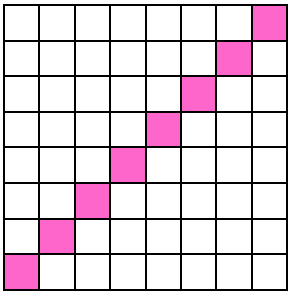
Observations

Number of blocks along the diagonal is 2.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 4, which is also the product of the length and width.



Observations

Number of blocks along the diagonal is 10.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 100, which is also the product of the length and width.



Observations

Number of blocks along the diagonal is 8.
Numbers of blocks on the vertical and horizontal are the same.
Total number of blocks is 64, which is also the product of the length and width.

Perfect Squares Chart

Name _____ **Date** _____

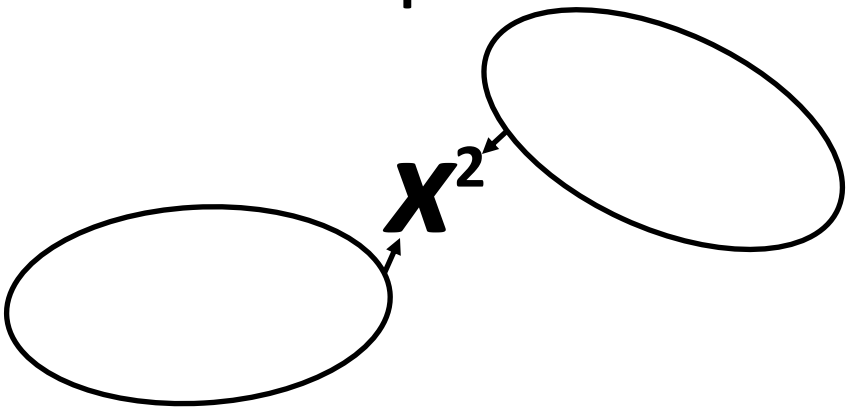
How can I write 9 · 9 in a condensed form? _____

This can be read as "_____" or "_____."

How can I write 4 · 4 in a condensed form? _____

This can be read as "_____" or "_____."

What are the parts called?



PERFECT SQUARES

n	n^2
1	1 · 1 = 1
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Multiplication Table

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144